

MEMORIAL

WILLIAM BURKE CRITCHFIELD
(1923–1989)

William B. Critchfield died 11 July 1989. He left a legacy unparalleled in forest genetics. Bill made major contributions to understanding genetic variation, hybridization, growth and development, biogeography, paleobotany, systematics, and taxonomy of forest trees, especially pines. In each of these fields, Bill's pioneering work earned him the position of world authority. These studies were mainly spinoffs from groundwork Bill was meticulously laying for his primary interest: unraveling the evolutionary history of conifers. And it is his evolutionary syntheses that best reveal Bill's breadth as geneticist and scholar.

Bill was born 21 November 1923 in Minneapolis, Minnesota, but grew up in North Dakota where his father had been among the state's pioneering settlers. He attended North Dakota Agricultural College (now North Dakota State University) before serving in the Navy during World War II. Upon returning from the South Pacific, he entered the University of California at Berkeley, where he completed his bachelor's degree with honors in Forestry in 1949 and his doctorate in Botany under Herbert Mason in 1956.

Bill's first position after receiving his doctorate was at Harvard University, where he worked from 1956–1959 as Geneticist with the Maria Moors Cabot Foundation for Botanical Research. In 1959 he moved back to Berkeley, California to join the Pacific Southwest Forest and Range Experiment Station of the U.S. Forest Service. He divided his time for the next 28 years between his office in Berkeley and the herbaria and arboreta of the Institute of Forest Genetics in Placerville. In 1972 he was appointed a Pioneering Research Scientist, an honor reserved by the Forest Service to promote the work of its most outstanding scientists. As one of only seven pioneering scientists in the agency, Bill was given *carte blanche* to pursue research of his own choice and design.

Bill's inferences about conifer evolution were grounded in an intimate knowledge of genecological variation. His early work on geographic variation and subspecific differentiation in lodgepole pine was seminal. He observed and measured morphological, physiological, and biochemical variation, and its relation to the environment in western conifers. He was convinced of the importance of studying species in their natural habitat, despite difficulties of access. In his studies of lodgepole pine in the 1950's, for example, he traveled the range of the species from California to Canada to Colorado by public buses, setting off from remote terminals to reach his forest destination on foot. He was alone on one collecting trip in British Columbia when he fell out of a tree, broke his back, and had to crawl to a road for help.

When Bill first joined the Forest Service, the Institute of Forest Genetics was engaged full-swing in a program of interspecific hybridization. Pine hybrids were being produced en masse and tested for their use in forestry and tree breeding. Jack Duffield, who had been at the Institute from about 1945–1955 had begun to use crossability as a measure of phylogenetic relationship among taxa. Bill continued this work with his own program of hybridization among pines and firs. Bill was unrelenting in his demand for experimental controls in this work. He insisted that only crosses using the same seed parent were comparable, and he was not willing to measure crossability by accepting the convention of counting the number of cones or seeds produced after artificial pollinations. He insisted instead on growing progeny in the nursery to confirm or reject their hybrid condition himself.

Bill soon became the leading authority on interspecific hybridization of pines. In

publications from 1963 to 1988, he shed light on hybridization and evolutionary relationships among almost all the subsections of *Pinus*, including the southern and western yellow pines, *Contortae*, *Sylvestres*, the California big-cone and closed-cone pines, the foxtail pines, and the white pines. He even studied hybridization among the western firs.

Bill's quest to determine evolutionary relationships among pines led him also to study their biogeography. Bill became the world's foremost authority on the geographical distribution of pines, and, with Elbert Little, he published a monumental book of maps that detailed ranges of every pine species. This book may well be the most widely cited reference in forestry. At a regional level, Bill undertook the enormous task of mapping all 86 tree species in California. In this book, Bill and coauthor Jim Griffin mapped the species in great detail, including both major and minor populations of the species, and even stands of only a few trees. For anyone who has relied on finding disjunct or tiny stands of California trees, Bill's map book is meticulous in its accuracy. The availability of such detailed information has allowed a standard of accuracy unprecedented elsewhere. These books are widely used references in many fields in addition to forestry, and although they were published years ago, they are still being requested.

Bill was a world authority on pine systematics and taxonomy. Since pines were first scientifically described by Linnaeus in 1753, over 40 classification systems have appeared. Of these, George Russell Shaw's evolutionary treatment of pine classification in 1914 set a new standard. With Elbert Little, Bill continued in the line of Shaw, and published a revised evolutionary classification of pines in 1966 and 1969. This system incorporated modern information on genetic variation in pines and on evolutionary relationships based on pine hybridization work. Furthermore, Critchfield and Little brought the nomenclature of the genus up to botanical code, an awesome task because invalid Latin names for pines proliferate wildly in the literature.

Critchfield and Little's classification stands as the accepted authority for pines. New species that have been discovered since its publication corroborate the classification. Bill became the world authority in identifying pine species, and he spent many hours with razor blades and dissecting scope making identifications for colleagues. Bill's botanical training amply prepared him for investigations of anatomy, and he had lifelong interests in morphology and ontogeny as subjects in themselves.

In later years, Bill realized that only when genetic information is combined with the paleohistoric record can present phylogenetic relationships of taxa be elucidated. This came as a personal revelation to Bill, and he would shake his head in amazement when he recounted how the thought of taking a course in paleobotany as a graduate student in evolution never occurred to him.

Bill more than made up for that lack in his past during his last ten years. With unbridled enthusiasm, he dissected the literature on the Quaternary history of North American conifers, and in case after case, made sense of anomalous patterns of genetic variation by documenting historic migrations and refugia. His seminal papers on this topic, culminating in "Impact of the Pleistocene on North American Conifers", were ahead of their time, with implications still not fully appreciated by the scientific community. He had begun work on similar topics for Japan and western Europe that unfortunately he will be unable to write.

Bill's scientific contributions went far beyond the professional papers he published and lectures he presented. He devoted long hours to related botanical efforts. At the Institute of Forest Genetics in Placerville, he reorganized and expanded the collection of herbarium specimens into what is probably the most complete pine herbarium in the world¹. To the National Forest System of the Forest Service, he contributed much of his time promoting the Research Natural Areas program, a system of ecological reserves that protects representative vegetation communities of the region. And when

¹ The herbarium was recently named the William B. Critchfield Conifer Herbarium in his honor.

the California Native Plant Society was first documenting the extent of rare and endangered plants in California, Bill was a major contributor.

The many scientists who were peers or apprentices of Bill remember him as much for how he conducted science as for his accomplishments. Bill was foremost a scholar. He was relentlessly thorough and devastatingly honest. His literature searches left no lead untraced; his reviews of manuscripts were incisive. Once when he was showing me around the basement of the Institute of Forest Genetics, he pointed to a large collection of musty boxes containing cones from an old study. "I'm glad I kept those," he said, "because when I reviewed a manuscript recently, the author was building a shaky hypothesis that I wanted to test independently. I brought out all these old cones and measured them, and sure enough, the hypothesis didn't hold water." After his death, in poking through the herbarium, I came across an old note on a napkin from a colleague, in which he asked Bill a casual question about pine morphology. Bill's five-page typed reply, complete with references, was stapled to the napkin.

Bill was one of the best investments the Forest Service ever made, if for no other reason than the cost/benefit ratio was so high. He made his most significant contributions without recourse to highly technical equipment. His most sophisticated laboratory tool was a dissecting scope, and his annual supply budget consisted mostly of new packs of razor blades. His most well-honed tool was the language. He had a lifelong love affair with words. He treasured them, savored them, and used them with precision.

The epithet most often used for Bill in addition to scholar is mentor. Bill gave equally of his time and scholarship to others. Although he was never formally a professor or teacher, his professional judgement was sought by peers and students alike, but students especially would beat a path to his door, and he always received them. He had a warm and generous relationship with students, and was equally capable of being serious or frivolous with them. Completely missing from Bill was any formal facade or aloofness that drives students from seeking counsel of many established scientists. Bill loved his adventures with students, and he enjoyed as much as they did telling jokes on himself. Over the years, summer interns at the Institute of Forest Genetics developed nicknames for Bill, including "Critch", "Mr. Bill", and "Mr. Institute". These names show the range of feeling students felt for Bill, from endearment to profound respect.

Bill was the glue that held his colleagues together in the Forest Service. They gathered around him at coffee, they gravitated toward his raspy voice in the hall. He was the one who regularly gave parties for his colleagues at his small bachelor apartment in Berkeley. His hospitality was legendary, despite his grumbling about people "staying past 10 PM".

After his retirement from the Forest Service in early 1988, Bill set forest genetics aside. He had too much more to do. He had his lifelong loves of theater and mystery novels to indulge. And he had ambitions for many new pursuits. He began taking college courses in literature, history, and art; he was working on a world gazetteer of maps for famous crimes, fictional and real, at the time of his death. In his hobbies as well as his profession, Bill applied his characteristic thoroughness and honesty.

Bill had a bad heart. In 1974 and Christmas 1988 he had major heart attacks. A three-way bypass after his last attack gave the promise of many more productive years. On 11 July 1989, however, a sudden massive heart attack took his life. Critch died doing one of the things he loved best, attending theater in San Francisco.—
CONNIE MILLAR, Institute of Forest Genetics, Berkeley, CA, with contributions from M. T. Conkle, B. B. Kinloch, R. M. Lanner, and F. T. Ledig.